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MIL-STD-1660 TEST OF PA116 WOOD PALLET WITH TOP LIFT ASSEMBLY DRAWING -807

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PREPARED FOR:

U.S. Army Armament Research, Development and Engineering Center

ATTN: SMCAR-ESK

Rock Island, IL 61299-7300

EVALUATION DIVISION
SAVANNA, ILLINOIS 61074-9639

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The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to retest unitization procedures for PA116 container on wood pallets. The tested configuration was six containers high with the redesigned top lift assembly. The unitization satisfied the test requirements of MIL-STD-1660, Design Criteria for Ammunition Unit Loads. However, PA116 container damage can be expected due to deformation of the square rings. It is imperative that the strength of the square ring be improved to provide a greater margin of safety in ensuring the rounds are accessible to the user.

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U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
Evaluation Division
Savanna, IL 61074-9639

REPORT NO. EVT 22-89

MIL-STD-1660 TEST OF

PA116 WOOD PALLET WITH TOP LIFT ASSEMBLY

DRAWING -807

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division, was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to test unitization procedures for PA116 containers on wood pallets for the U.S. Marine Corps in a six-containers-high configuration with the redesigned top lifting adapter. The criteria used for evaluating the PA116 container wood pallet with top lifting adapter was MIL-STD-1660, Design Criteria for Ammunition Unit Loads.

B. AUTHORITY. This test was conducted IAW mission responsiblities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of these tests was to determine if the PA116 container shipped in a six-high-unit with a top lifting adapter could satisfy the testing requirements of MIL-STD-1660.

PART 2

ATTENDEES

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PART 3

TEST PROCEDURES

The test procedures outlined in this section are extracted from MIL-STD-1660, Design Criteria for Ammunition Unit Loads, 8 April 1977. This standard identifies nine steps that a unitized load must undergo if it is considered to be acceptable. These tests are synopsized below:

1. STACKING TESTS. The unit load shall be loaded to simulate a stack of identical unit loads stacked 16-feet high, for a period of one hour. This stacking load is simulated by subjecting the unit load to a compression of weight equal to an equivalent 16-foot stacking height. The compression load is calculated in the following manner. The unit load weight is divided by the unit load height in inches and multiplied by 192. The resulting number is the equivalent compressive load of a 16-foot-high stack.

2. LOOSE CARGO TRANSPORTATION TEST. The Loose Cargo Transportation Test shall be conducted IAW Method 5019, Federal Standard 101. The test procedure is as follows: The test specimen shall be placed on, but not fastened to, the platform. With the specimen in one position, vibrate the platform at 1/2-inch amplitude (1-inch double amplitude) starting at a frequency of about 3 cycles-per-second. Steadily increase the frequency until the package leaves the platform. The resonant frequency is achieved when a 1/16-inch-thick feeler may be momentarily slid freely between every point on the specimen in contact with the platform at some instance during the cycle or a platform acceleration achieves one plus or minus zero point one G. Midway into testing period the specimen shall be rotated 90 degrees and the test continued for the duration. If failure occurs, the total time of vibration shall be two hours if the

specimen is tested in one position; and if tested in more than one position, the total time shall be three hours.

3. EDGEWISE ROTATIONAL DROP TEST. This test shall be conducted by using the procedures of Method 5008, Federal Standard 101. The procedure for the Edgewise Drop (Rotational) Test is as follows: The specimen shall be placed on its bottom with one end of the base of the container supported on a sill nominally 6 inches high. The height of the sill shall be increased, if necessary, to ensure that there will be no support for the base between the ends of the container when dropping takes place, but should not be high enough to cause the container to slide on the supports when the dropped end is raised for the drops. The unsupported end of the container shall then be raised and allowed to fall freely to the concrete, pavement, or similar underlying surface from a prescribed height. Unless otherwise specified, the height of drop for level A protection shall conform to the following tabulation.

GROSS WEIGHT NOT EXCEEDING	DIMENSIONS ON ANY EDGE NOT EXCEEDING	HEIGHT OF DROP LEVEL A PROTECTION
Pounds	Inches	Inches
600	72	36
3,000	no limit	24
no limit	no limit	12

4. LIFTING WITH MECHANICAL ATTACHMENTS (TOP SLINGING) TEST. This test is based on Method 5011, Mechanical Handling Test of Federal Standard 101, paragraph 6.3, Hoisting with Slings. The slinging for this unitization is accomplished with a four legged sling. The length of the slings will be such that, when lifting, the slings form angles between 20 degrees and 25 degrees with the horizontal plane of the specimen. The specimen shall be lifted clear of the floor and will remain suspended for not less than 2 minutes. The

specimen shall be lifted with four legs, three legs, two legs diagonal, two legs alternate diagonal, two legs lateral, two legs longitudinal and by a single sling leg. Record observations of each lift and then lower to the ground.

5. IMPACT TEST. This test shall be conducted by using the procedure of Method 5023, Incline-Impact Test of Federal Standard 101. The procedure for the Incline Impact Test is as follows: The specimen shall be placed on the carriage with the surface or edge, which is to be impacted, projecting at least 2 inches beyond the front end of the carriage. The carriage shall be brought to a predetermined position on the incline and released. If it is desired to concentrate the impact on any particular position on the container, a 4x4-inch timber may be attached to the bumper in the desired position before the test. No part of the timber shall be struck by the carriage. The position of the container on the carriage and the sequence in which surfaces and edges are subjected to impacts may be at the option of the testing activity and will depend upon the objective of the tests. When the test is to determine satisfactory requirements for a container or pack, and unless otherwise specified, the specimen shall be subjected to one impact on each surface that has each dimension less than 9.5 feet. Unless otherwise specified, the velocity at time of impact shall be 7 feet per second.

6. DISASSEMBLY TEST. Following all rough handling tests, the unit load may be squared up within 2 inches of its original shape and on a flat level surface. The strapping shall then be cut and removed from the palletized load. Assembly of the load shall be such that it retains its unity upon removal of the strapping.

PART 4

TEST EQUIPMENT

1. TEST SPECIMEN.

   a. Width: 40-1/8 inches

   b. Length: 44-1/2 inches

   c. Height: 53 inches

   d. Weight: 2,615 pounds

2. COMPRESSION TESTER.

   a. Manufacturer: Ormond Scientific

   b. Platform: 60 inches by 60 inches

   c. Compression Limit: 50,000 pounds

   d. Tension Limit: 50,000 pounds

3. TRANSPORTATION SIMULATOR.

   a. Manufacturer: Gaynes Laboratory

   b. Capacity: 5,000 pounds

   c. 1/2-inch Amplitude

   d. Speed: 50 to 300 rpm

   e. Platform: 5 feet by 8 feet

4. INCLINED RAMP

   a. Manufacturer: Conbur Incline

   b. Impact Tester

   c. 10 Percent Incline

   d. 12-Foot Ramp

PART 5

TEST RESULTS

1. COMPRESSION TEST

a. Pallet Data

(1)	Weight	2615	pounds
(2)	Height	51 1/2	inches
(3)	Test Load	9750	pounds

b. Applied test load duration 60 minutes

c. Observations: Banding straps loosen under compression. Returned to normal after test load removal. Interlock on rear square ring of row 5, column 4-5 intersection would not seat properly.

2. LOOSE CARGO TRANSPORTATION TEST

a. Longitudinal orientation.

(1)	Operating speed	130	rpm
(2)	Test Duration	90	minutes

(3) Observations: Visible damage to square rings.

b. Lateral orientation.

(1)	Operating speed	200	rpm
(2)	Test Duration	90	minutes

(3) Observations: Visible damage to square rings. Pallet rocked on center skid.

3. EDGEWISE ROTATIONAL DROP TEST

a. Side 1

(1)	Drop Height	24	inches
(2)	Unit orientation	lateral	

(3) Observations: No visible damage. Unit skewed four inches from vertical at top.

b. Side 2

(1)	Drop Height	24	inches
(2)	Drop orientation	longitudinal	

(3) Observations: No visible damage.

c. Side 3

(1)	Drop Height	24	inches
(2)	Drop orientation	lateral	

(3) Observations: No visible damage. Unit returned within one inch of vertical.

d. Side 4.

(1)	Drop Height	24	inches

(2) Drop Orientation longitudinal
(3) Observations: Broken center skid wing. Bowed pallet caused full unit load to be supported on end of wing.

4. SLING TEST

a. Four leg pickup, no visible damage.

b. Three leg pickup, no visible damage. Toplift warped downward at unsupported pickup point.

c. Two leg diagonal pickup, no visible damage. Toplift frame formed a hyperboloid. (Pickup points deformed up, pullup points deformed downward.)

d. Two leg alternate diagonal pickup, no visible damage. Toplift frame formed a hyperboloid.

e. Two leg lateral edge pickup, no visible damage. No deformation in the toplift assembly.

f. Two leg longitudinal edge pickup, no visible damage. No deformation in the toplift assembly.

g. One leg pickup, no visible damage. Two inch displacement between toplift at pickup point and sixth row of containers.

5. INCLINED IMPACT

a. Drop height for all impacts 7

b. Side 1
(1) Orientation Lateral
(2) Observations: Visible damage to container interlocks.

c. Side 2
(1) Orientation Longitudinal
(2) Observations: No visible damage

d. Side 3
(1) Orientation Lateral
(2) Observations: Visible damage to container interlocks.

e. Side 4
(1) Orientation Longitudinal
(2) Observations: No visible damage.

6. DISASSEMBLY OBSERVATIONS

a. The largest amount of damage to the square rings occurred in rows 1 and 2. Damage density decreased in upper rows.

b. Containers in the bottom row were 'out of round' on the surface contacting the pallet deck

c. Lateral damage to the interlocks prevented easy disassembly of containers.

d. Paint abrasion was observed on the bottom row of containers.

PART 6

CONCLUSIONS, APPROVAL and RECOMMENDATION

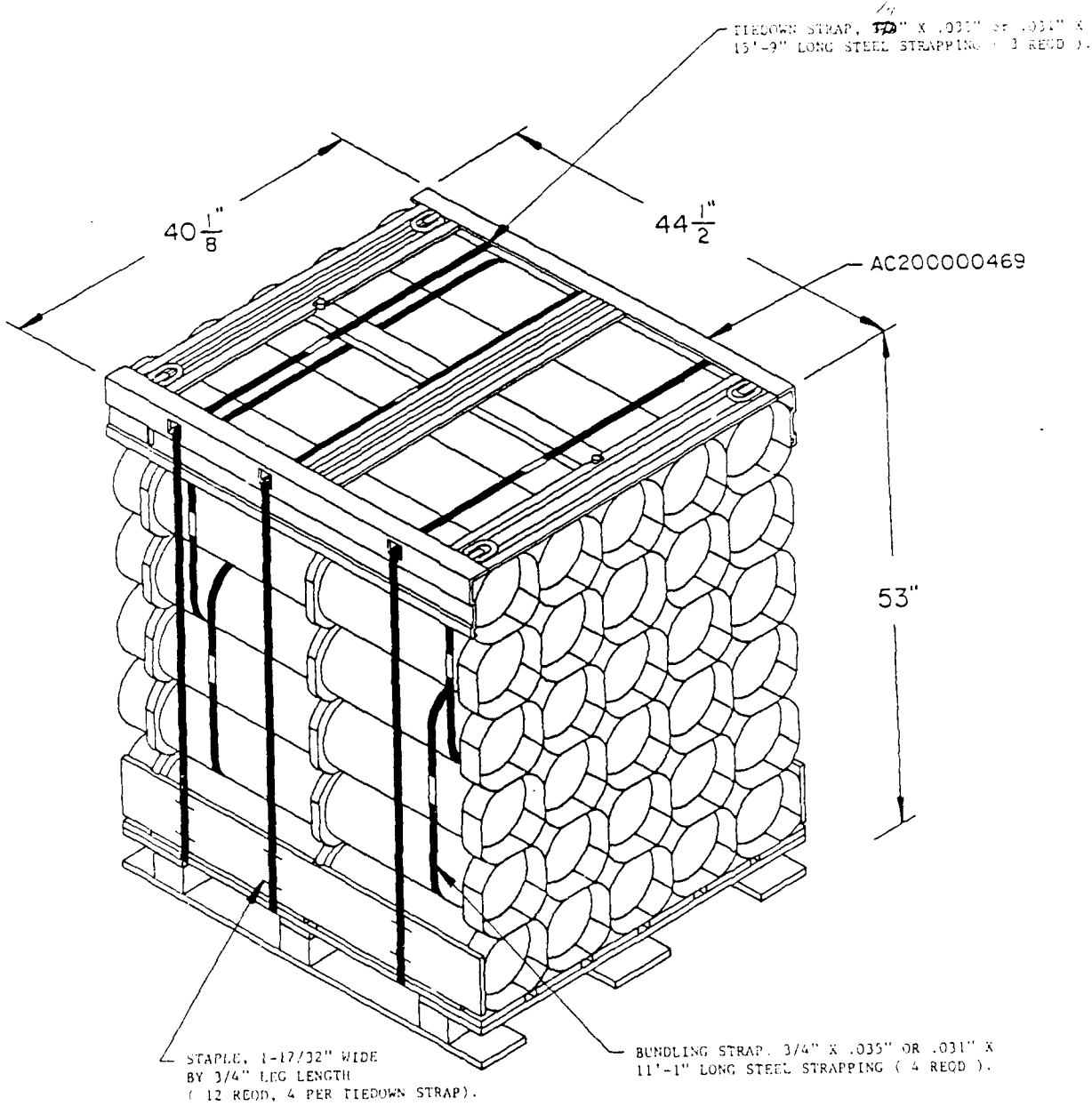
1. CONCLUSION(S). As tested, the unitization was marginal but acceptable in that the unit load maintained its integrity and the rounds were still accessible. There is some loosening of the straps due to the deformation of the PA116 container square rings.

2. APPROVAL. This unit is approved for Army use.

3. RECOMMENDATION. The PA116 containers, as currently fielded, can be expected to experience damage due to lack of strength. It is recommended that action be taken to strengthen the square rings.

PART 7

UNITIZATION DRAWING


TIEDOWN STRAP, 1/2" X .035" OR .031" X
15'-9" LONG STEEL STRAPPING (3 REQD).
40 1/8"
44 1/2"
AC200000469
53"
STAPLE, 1-17/32" WIDE
BY 3/4" LEG LENGTH
(12 REQD, 4 PER TIEDOWN STRAP).
BUNDLING STRAP, 3/4" X .035" OR .031" X
11'-1" LONG STEEL STRAPPING (4 REQD).